III. RECOMMENDATIONS/IMPLEMENTATION PLAN

1. OVERVIEW

This implementation plan consists of developing and installing a CVO system using intelligent transportation system ITS technology at the Nogales international border POE.

The proposed system will be deployed as a means to enhance commercial vehicle movements across the international border while improving safety and enforcing trade and legal compliance. The project will place electronic transponder tags on commercial vehicles that cross the border and will install roadside tag readers at strategic locations along the corridor from Phoenix to the Nogales POE, along Interstates 10 and 19. The tags will permit electronic communication of crucial information about a truck and its cargo to both CBP and the ADOT. This will reduce the level of paper-based credentialing and manifesting transactions, and the delays associated with these transactions.

The proposed system will use a system architecture developed as part the FHWA's ongoing CVISN program, the FHWA's International Border Clearance (IBC) architecture, the CBP's Automated Manifest System (AMS), and ADOT's EPIC project. This proposed implementation plan is based on a corridor-level perspective that recognizes that an international border is functionally much more than a line between two countries. The work will be conducted in coordination with the FHWA, ADOT, the Arizona DPS – Highway Patrol, and the CBP. It will acknowledge other border-oriented ITS and roadway construction projects occurring within Arizona and Mexico. The deployment will use proven technology and will be interoperable with federal CVO programs at other border crossings. The first phase of this multi-phase project will allow expansion to accommodate larger trade areas and new technologies.

1.1 Proposed Project Implementation Objectives

The overall proposed project objectives of this proposed border crossing CVO system include the following:

Compliance Assurance: By automating a portion of the CBP's and the ADOT's inspection processes, a CVO system can reduce the negative impacts of safety and border inspections for safe and reputable carriers while better focusing personnel resources on noncompliant carriers.

Electronic Screening-Clearance via EDI: ITS will allow trucks to be electronically screened for safety and cargo clearance, so that compliant and legal operators may avoid unnecessary delays, and enforcement personnel may focus on carriers and drivers who may be noncompliant.

Future Growth: By developing a working system from available funding and technology, this project will provide the foundation for a more technologically advanced ITS/CVO border system that serves a greater number of commercial vehicles and a larger trade area.

1.2 Key ITS Enhancement Elements

The project will have three main elements that are discussed as follows:

Container System - This system will permit the CBP at the Nogales, Arizona border crossing to preview manifests for truck-borne containers from participating shippers traveling north and south across the border. The readers and tags will communicate using the ISO 10374 standards. The tags will contain information linked to CPB's Automated Manifest System, or AMS.

Power Unit Identification System - Transponders and Weigh-in-Motion (WIM) equipment will be combined to identify CVO power units (the tractor). Electronic tags on the power units will allow compliant trucks to bypass the weigh station, as well as permit the DPS to electronically review safety and driver information. The tags and readers will comply with the FHWA's standard for Dedicated Short Range Communications (DSRC).

Container/Power Unit Linkage - This element establishes an interface linking the ISO tags on the containers and the ASTM tags on the tractor power units that haul the containers. This interface, whether software or hardware, will allow CBP to access travel time information and the DPS to determine the contents of containers.

2. PROPOSED PROJECT GUIDELINES

Project development will need to meet a number of general guidelines. These guidelines ensure that the project will use technologies that have already been proven, will result in a system that is fully interoperable on a national and international level based on a corridor-level perspective, will foster and rely on cooperation and coordination with a number of jurisdictions, and will be designed for future expansion. These guidelines are discussed in greater detail in the following sections:

Proven Technology - The technology used for this CVO border system will be commercially available and with have been tested in other locations. This project is not designed to be a test of untried technologies.

Interoperability - The project will follow the IBC system architecture and be interoperable with other border crossing data systems. These include the field demonstration of the North American Trade Automation Prototype (NATAP) initiative being tested by the field operational tests. NATAP, which is a joint initiative among the United States, Canada, and Mexico, is standardizing data and document processing for trade agencies involved in border clearance.

This project shall support national-level commercial vehicle data interoperability by using the CVISN architecture being developed by the John Hopkins University/Applied Physics Lab. This architecture shall form a communication network for sharing crucial commercial vehicle information and will form the framework for the databases used in this effort. This project shall use the CVISN standards to ensure that the system complements the FHWA's efforts to develop a national ITS architecture and shall support the long-term success of national and international CVO operations.

Corridor-level Perspective - For this project, the border will be considered part of a corridor stretching from Phoenix to the Nogales POE, along Interstates 10 and 19. . This perspective is important because it will permit a more flexible and functional approach to enhancing commercial vehicle movements on the transportation system. This corridor can be expanded as the border system grows.

Institutional Integration - This project will depend on cooperation and coordination among a number of jurisdictions. The eventual system design for the corridor will be the product of cooperation among agencies with jurisdiction in the border corridor, as well communication with end users of the system.

A number of governmental agencies have ongoing or planned projects that are oriented toward vehicle movements across the border. This project provides a timely opportunity to cooperate and integrate with these other programs. This will both enhance the success of this project and assist other agencies in their goals

Development of this project will provide a framework for growth beyond the Nogales border corridor. Commercial vehicles traveling from ports east and west of Nogales along the U.S.-Mexico border may be able to tie into a CVO border system. Eventual expansion and coordination with other states or federal regions would also be reasonable. Recognizing the longer-term potential inherent in this project, the system design and project recommendations will be oriented toward future expansion. Specifically, this project will be considered an initial phase that is focused on the deployment of a usable system in one corridor. This first step will guide the development of additional phases that expand the CVO system to other areas and to greater numbers of commercial vehicles.

2.1 International Border Clearance (IBC) Program

The proposed system will use a system architecture developed as part the FHWA's ongoing FHWA's International Border Clearance (IBC) architecture.

The vision of the IBC program is to provide "seamless, harmonized, and timely clearance of international commerce between and through trading countries resulting in safe and legal commercial operations. This vision is to be achieved through the harmonization of documentation, the standardization of data elements, and the acceptance of an international data syntax for the exchange of transportation and trade data." The IBC program was initiated under the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA). Although the program was initially intended to be a means of using ITS to enhance the efficiency of processing commercial vehicles at international border crossings and to improve the safety of those vehicles, it was later expanded to assist the U.S. Treasury Department in gathering and efficiently processing import/export data.

Under this program, ITS equipment has been implemented at seven border crossings – five with Canada and two with Mexico. This effort has been closely coordinated with various federal, state, and local agencies, shippers and carriers, and the FHWA, which has sponsored the implementation of local processing and network systems that provide connectivity to other governmental agencies. The IBC program coordinates the incorporation of modern advancements in Information Technology (IT) and vehicle identification systems to more efficiently and accurately monitor the vehicles, cargos, and drivers as they enter the United States. The program is continuing to expand, as interfaces with state commercial vehicle information systems are developed under the FHWA ITS/CVO program. This overall effort results in faster and more accurate processing of shipments, while easing congestion and improving the environment.

The IBC program is primarily comprised of four components:

- Implementation of technology at various border crossing sites.
- Interfaces with existing and planned governmental processing systems.
- Partnerships with transportation, customs, and immigration entities in the United States, Mexico, and Canada.
- Interaction with private stakeholders involved with commercial border crossing activities.

During initial IBC program testing in Fiscal Year 97-98, ITS technology was deployed at several sites including Nogales. Subsequent testing that took place in Fiscal Year 2000-01 in Laredo, Texas and Detroit, Michigan, demonstrated a Freight and Trade Processing System (FTPS), which had a direct interface with the CBP. FTPS technology can enhance efficiency at border crossings by validating vehicle and driver safety status prior to crossing the border.

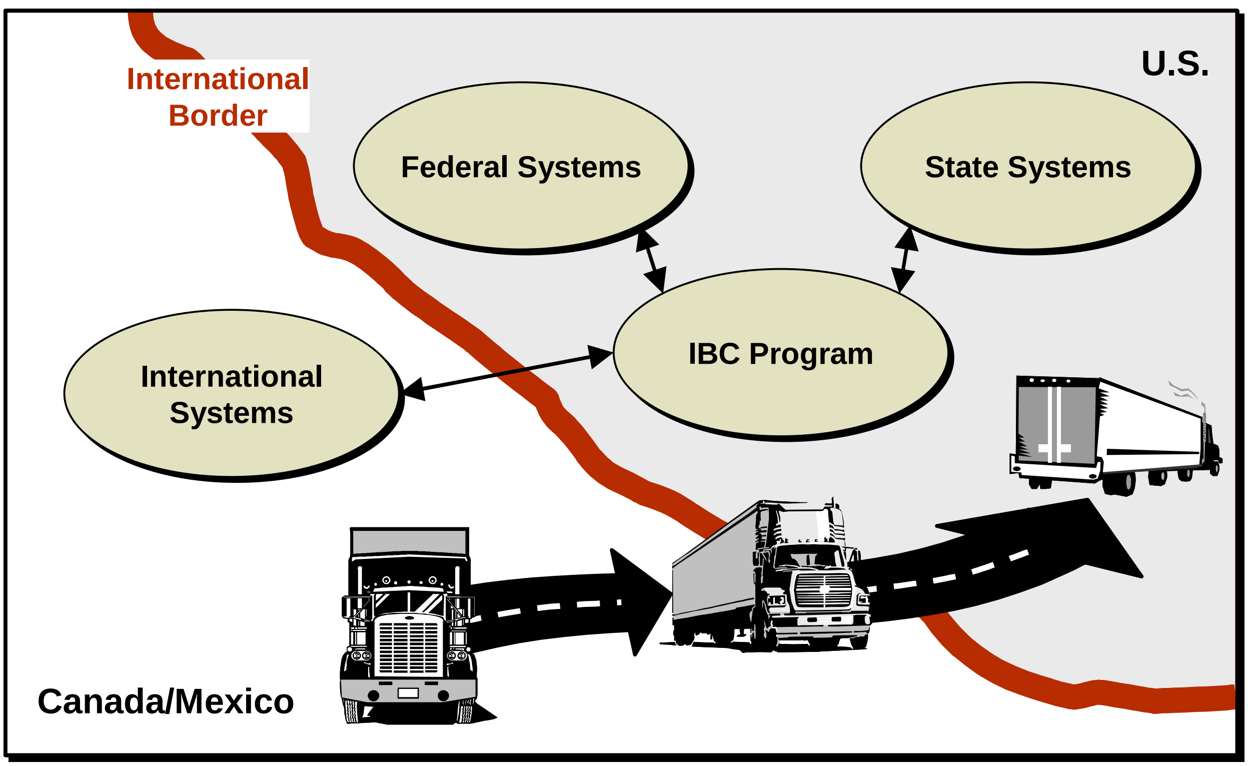

Figure 5 – IBC Conceptual Overview

There are 65 U.S. governmental departments and agencies that are directly or indirectly involved in monitoring, quantifying, or enforcing the regulations of international trade movement. The major ones of these include:

- Department of Transportation.
- Department of the Treasury.
- CBP.
- Immigration and Naturalization Service.
- FDA.
- USDA.
- FHWA.

The Office of Freight Management and Operations (within the FHWA) is managing the IBC program, including the installation and upgrading of ITS equipment at the border crossing sites and the integration with systems in the United States, Mexico, and Canada.

The law enforcement agencies of the individual states are responsible for the enforcement of truck weight and safety laws, although at selected border crossing such as the Nogales POE, they are assisted by FMCSA inspectors.

2.1.1 Concept Of Operations

Trading firms, often through shipping brokers, will electronically file shipment declarations to the CBP prior to the arrival of the shipment at the border. The declarations contain information for both the cargo and the carrier/vehicle/driver, following the protocol specified by the North American Trade Automation Prototype as a baseline interface to the International Trade Data System being developed by the U.S. Treasury. The declarations will be evaluated prior to the shipment arriving at the border; additionally, the Freight and Trade Processing System will allow state agencies to screen and evaluate each carrier, vehicle, and driver and report their findings back to the FTPS.

When the shipment arrives at the border crossing, a unique transponder code aboard the vehicle is read and forwarded to Washington, D.C., where the prescreening results are retrieved and returned to the CBP officials at the border crossing. At this point the vehicle, driver, and shipment can be automatically cleared to proceed or held for further inspection.

In its final form, the IBC system architecture, and the FTPS or equivalent system, will be able to:

- Permit connectivity with state and federal vehicle information systems for safety or credentials verification.
- Provide access by other organizations regarding the status of a particular shipment.
- Provide connectivity with state roadside inspection facilities.
- Accommodate a wide variety of information management scenarios.

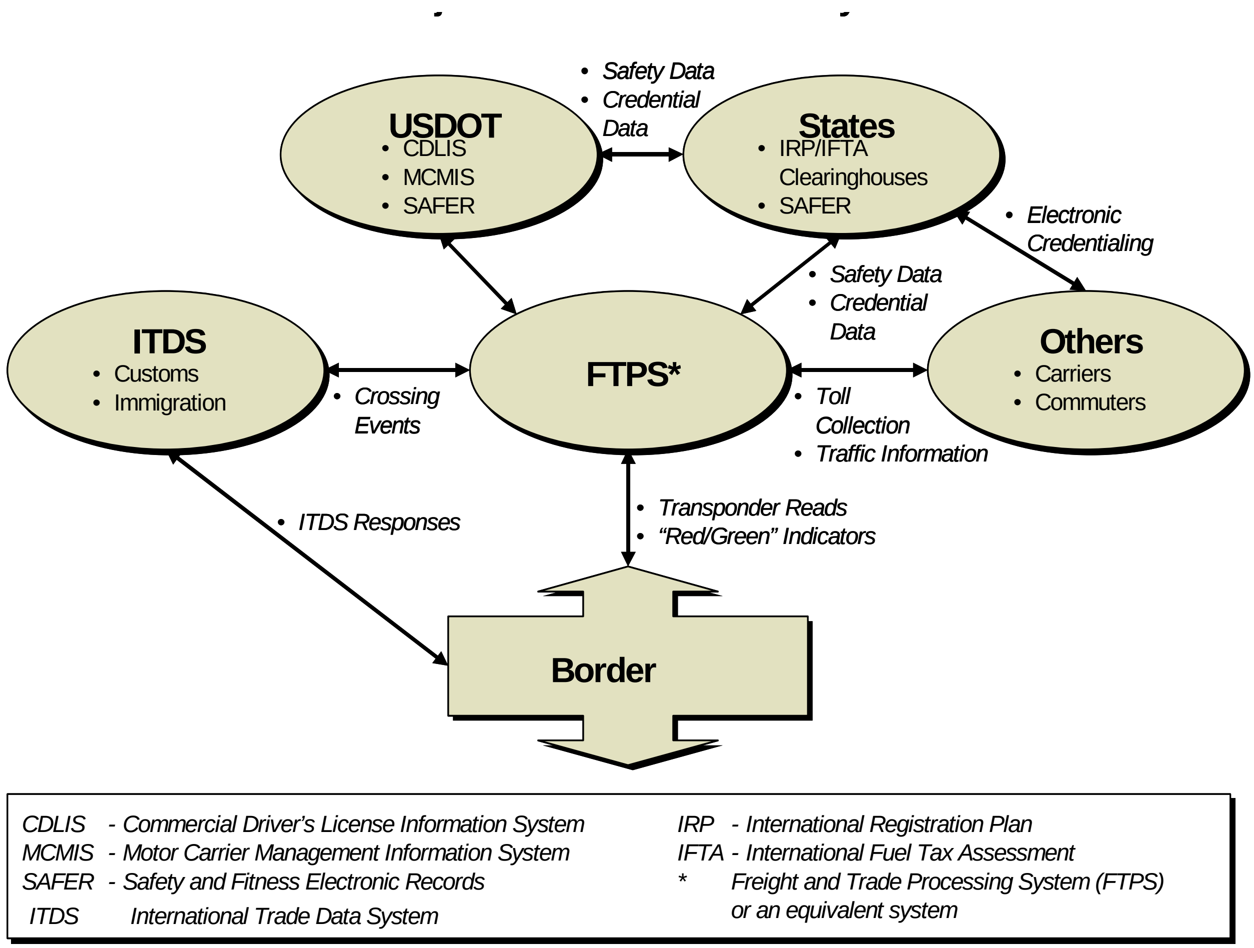

Figure 6 Projected IBC Interconnectivity

2.2 ADOT Nogales Port Of Entry Status

As Arizona's main commercial truck crossing, Nogales processes all international commercial traffic entering the state. According to the U.S. Department of State, 60% of all winter produce consumed in the United States and Canada passes through Nogales, Sonora, which makes Nogales the largest inland port for fruits and vegetables in the United States. Due to the nature of this traffic, most of the international truck shipments through Nogales occur during the winter months.

The Nogales POE, which is located at Mariposa, approximately three miles west of central Nogales, is equipped with one fixed weigh and inspection station, augmented by mobile inspection devices used by inspectors. This equipment includes wheel scales, roll-up mat scales, and a Special Response Interactive (SPRINT) port. Additional types of portable scales are used as necessary in the facility and by detail strike forces.

2.2.1 Key Attributes Of Nogales

The following are key attributes of the Nogales POE.

- U.S. and Mexican agencies are working together at Nogales to improve their relationships and work towards a common agenda, enhancing safety and facilitation of trade.

- Mexico has invited the ADOT MVD to set up a satellite office to pre-process Mexican trucks before they reach the U.S. border.

- U.S. CBP and ADOT work together to staff and process trucks at the "Superbooth," which has a goal of processing 60% of the trucks in queue.

- Arizona DPS has trained 80 Mexican motor carrier inspectors at over 10 sites since 1995; however, Mexico has not yet passed the laws that are necessary for enforcement, and delays in the full implementation of NAFTA have impeded interest in cross-border training.

- Arizona DPS has also trained inspectors for other agencies in Arizona; these other agencies conduct approximately one-third of Arizona's commercial truck inspections.

- Both random and discretionary inspections are carried out. Once a vehicle has been selected for inspection, an Inspection Selection System (ISS) identifies what specific inspection is to be conducted.

- The state of Arizona does not place a high emphasis on enforcement of federal commercial zone restrictions, and the extent of violations is not well known.

2.2.2 IBC At The Nogales POE

The implementation at Nogales included IBC along with Management Information System for Transportation (MIST™), variable message signs, closed-circuit television, and Weigh-in-Motion scales. Two additional slow-speed Weigh-in-Motion scales are installed on the approach to the U.S. CBP primary inspection site.

Expedited Processing At International Crossings (EPIC) Evaluation

The Field Operational Test of EPIC revealed a number of findings:

- By allowing electronic verification of trip permits, EPIC has the ability to significantly reduce – between 9 and 13 minutes – the amount of time a truck must spend in the border compound by eliminating the need for drivers to stop at the ADOT office. This saving does not apply to participating carriers registered in Arizona, who already do not have to stop in the ADOT office, although they could derive some benefit from receiving congestion information.

- Preclearance to use the Superbooth enabled vehicles to bypass the compound altogether, saving over 80% (25 minutes) of the normal travel time through the compound.

- ADOT estimates that EPIC preprocessing could save approximately two minutes for every trip report that did not require manual data entry.

- There are still some issues to be resolved:

  – Funding restrictions preclude fixed weigh stations at all ports; facilities lacking scales are often used to bypass inspections, although SPRINT ports can be used to circumvent this.

  – Additional capabilities of determining vehicle status – such as identification, systems, credentials, and operating condition – would be beneficial to facilitate faster processing and to enhance safety.

2.3 Border Clearance Program Lessons Learned

The following is a discussion of lessons learned regarding institutional, infrastructure, operations, technology, safety assurance, and border directional issues aspects of a border clearance program.

2.3.1 Institutional

Issues: Nontraditional relationships among border stakeholders has resulted in some uncertainty regarding effective methods for co-funding bi-national technology initiatives. For example, no method is in place for maintaining sensor systems like DSRC in a uniform manner in both nations.

Lessons Learned: As with many domestic ITS/CVO initiatives, institutional issues represent the most significant hurdle in deploying and using technology as a tool for improving processes at international borders.

Challenges: The local and international alliances formed in order to improve commercial vehicle movement at the border will continue to drive the level of success of IBC initiatives.

2.3.2 Infrastructure

Issues: At each of the border crossings investigated, planned and actual capital improvements of U.S. CBP compounds involved expansion of inspection areas, redesign of roadways to and from the border, and implementation of new technologies, yet plans for weigh and inspection facilities remain conspicuously absent in most locations.

Lessons Learned: CBP compound facility improvements play a major role in addressing the concern of excessive delay in processing through the border, but a combination of resource constraints and space limitations in many cases precludes the construction of fixed safety inspection facilities.

Challenges: Alternatives to fixed safety inspection facilities, including the application of ITS technologies, and the development of joint compounds in one of the countries, must continue to be explored to ensure that safe trucks entering the United States are not delayed.

2.3.3 Operations

Issues: Representatives at each site indicated expectations that the NAFTA would result in significant increases in traffic at international border crossings.

Lessons Learned: Little is known or understood regarding how cross-border goods movement business models will evolve once the full provisions of NAFTA go into effect, but the combination of increasing volume and diminishing levels of enforcement personnel is likely to result in continued delays.

Challenges: Further understanding regarding the future of such localized business phenomena, as drayage and storage yards on the southern border, must be developed if states are to effectively allocate resources along trade corridors.

2.3.4 Technology

Issues: At those POEs where IBC systems have been installed and tested, evaluation results have validated the technical feasibility of ITS to support federal, state and local trade and transportation processes.

Lessons Learned: Significant progress has been made in applying ITS international borders, but existing facility configurations limit the applicability of a uniform border system design/architecture.

Challenges: A continued focus on the refinement of technology, and the opportunities to demonstrate connectivity and interoperability with other federal and state systems will allow agencies to more effectively leverage IBC systems, and facilitate success at our international borders.

2.3.5 Safety Assurance

Issues: Development of an enhanced public safety policy can make significant strides in increasing the enforcement presence and apply ITS technology to aid inspection selection processes, while keeping in mind that targeted inspections may still be illegal in some states due to reasons of privacy. With the signing of Patriot Act, some states have adjusted their activity to accommodate security concerns and privacy issues.

Lessons Learned: The combination of more, better-trained inspectors and a strong focus on the development and employment of more efficient, effective inspection selection practices offers significant promise for ensuring the safety of non-U.S. trucks.

Challenges: Since one of the primary benefits of ITS is its usefulness in leveraging technology to focus enforcement, realizing its full value may require laws precluding selective inspections be amended or changed.

2.3.6 Directional Issues (Into and Out of the U.S. at the Nogales Border)

Issues: Differences in geography, topography, and road networks, combined with differences in cross-border goods-movement business models and crossing volumes at ports along the southern border, significantly influence the safety enforcement methods employed by state officials.

Lessons Learned: Differences between northern and southern border operations business models—primarily the result of drayage practices and vehicle inspection practices in Mexico and Canada—drive enforcement priorities and practices in the U.S. border states.

Challenges: ITS technologies have the potential to significantly improve operations in states where the construction of fixed weigh and inspection sites at each international border crossing is prohibitively expensive by allowing clearance of carriers that have a proven track record of safety and compliance.

2.4 Security Screening Approaches

The categories of vehicle security screening approaches that have been identified and evaluated by the Department of Homeland Security are:

- Whole-vehicle, nonphysically intrusive scanning technologies.
- Hand-held, moderately intrusive scanning instruments.
- Visual/physical, intrusive search methods.
- Use of trained dogs.

The following paragraphs describe each of these categories, with supporting examples of known applications for industry and government properties. Original Equipment Manufacturers (OEMs) were contacted for information on each technology, and for data to support the quantitative attributes cited in the analysis. For government agencies or industries that have allowed it, applications of specific technologies are cited.

It should be noted that none of the applications cited are entirely limited to one specific technology – each situation represents a combination of one or more technologies with human experience and judgment. For example, the CBP uses dogs, x-ray machines, wands, and scanners and the inspectors' judgment to determine if more intensive inspections are necessary after a random screening. The examples bear out that no single technology should be used as a sole screening tool and/or method.

2.4.1 Whole Vehicle Screening

Fixed x-ray vehicle inspection systems are available with a maximum hourly throughput of 20 vehicles and capable of penetrating solid steel more than 200mm thick. These installations can cost more than $10 million. Such equipment has been installed in inspection buildings for inbound and outbound vehicle traffic at Lok Ma Chau Control Point in Hong Kong. Costing about $113.8 million, the system consists of the following: components:

- X-ray generator (LINAC - Linear Accelerator).
- Detector array (converts the intensity of the X-ray received into electronic signals).
- Special Purpose Transport Mechanism (SPTM) (Flatbed).

- Control software.
- Image enhancement software.

X-ray vehicle inspection systems are safe and impose no hazard to properly trained operators or the occupants of the vehicles they screen. The passengers must exit the vehicle during screening to prevent their exposure. Training is necessary to ensure operator and public safety, to enable detection and identification of dangerous and prohibited items, and to ensure proper use of the four integrated applications listed above, including control and image enhancement software. This technology is available from several OEMs.

- **Time**: 10 minutes per vehicle.
- **Staff**: 2 minimum.
- **Intrusiveness**: No personal contact with vehicle.
- **Investment**: $10 million per installation.
- **Maintenance**: Minimal software administration, minimal calibration by OEM.
- **Expertise:** Requires specialized training estimated at two weeks and $1,600 each inspector.

Under-vehicle surveillance systems are available in mobile and static configurations that provide high-quality digital pictures of the undersides of vehicles. Such systems cost about $6,000 per installation. Vehicles can pass at speeds up to 25 km/hr, a high throughput in comparison with other methods. Any size vehicle can be driven over the CCTV capture system, which utilizes a touch screen interface to control zoom and storage functions. The system is typically used for border control, high security and military installations and prisons. Special training is required to prepare operators to identify vehicle undercarriage configurations on a CCTV display, identify recently modified components and access panels, and operate the system features, such as pan, zoom, and archiving of digital images.

The capability of this technology is limited to screening the undercarriage of the vehicle and must be combined with a means of checking the internal compartments of a vehicle. This technology is available through several OEMs.

- **Time:** 1 minute per vehicle.
- **Staff**: 2 minimum.
- **Intrusiveness**: No personal contact with vehicle.
- **Investment**: $6,000 per installation.
- **Maintenance**: Minimal software administration, minimal calibration by OEM.
- **Expertise**: Requires specialized training estimated at one week and $400 each inspector.

2.4.2 Portable Screening

Mobile multi-energy x-ray security inspection systems are movable devices that penetrate solid steel up to 25 mm thick, and can cost more than $150,000. Implemented at the Texas-Mexican border in McAllen-Hidalgo, such instruments are used to screen packages and luggage up to a maximum weight of 100 pounds. These instruments can be powered through the civil power system or an onboard power supply for two to hour hours. Smaller x-ray scanners for baggage and package screening can cost less than $100,000 for the equipment. In either case, baggage or packages must be removed from the subject vehicle for screening. Explosives are not easily detected by x-ray because many explosive compositions, frequently encountered, are not organic and will not show up (e.g., black powder, sodium chlorate, and flash powder mixtures). Dual-energy technology that helps distinguish between organic and inorganic materials is available as an add-on feature, at a cost of about $10,000. A special staging area is required for any x-ray technology utilized for package or luggage screening, also requiring additional time.

This technology is applicable to vehicle contents, but not to the overall screening of vehicles themselves. Locally effective statutes may prohibit the random search of passenger packages or luggage without probable cause.

Portable x-ray inspection systems are safe and provide no hazard to the operator with proper training. The passengers are not exposed because the packages/luggage is removed from the vehicle for screening. Training for operators of this type of equipment is necessary to ensure operator and public safety. Special training is required to ensure operators understand and observe relevant legislation and procedural requirements, as well as x-ray safety and material identification techniques. This technology is available through a number of OEMs.

- **Time**: 5 minutes per vehicle.
- **Staff**: 1 minimum.
- **Intrusiveness**: Personal contact with luggage/packages, vehicle needs to be unloaded.
- **Investment**: $150,000 per installation.
- **Maintenance**: Minimal software administration, minimal calibration by OEM.
- **Expertise**: Requires specialized training estimated at two weeks and $1,600 for the inspector.

Portable trace detectors are combined vapor and particle detectors. They cost between $25,000 and $40,000 per unit, and identify a limited range of explosives and chemicals by their particulate or gaseous elements respectively. They are hand-held weighing about six pounds with a warm up time of 10 minutes, analysis time of less than 30 seconds and a 90-minute battery life. The vapor detection capability identifies volatile explosive compounds with a high vapor pressure (i.e., nitroglycerin) but will miss plastic explosives such as PETN or black powder. Vapor detectors are capable of providing results in a few seconds. The particle detection capability analyzes trace amounts of chemical compounds found in some explosives. Some trace detectors integrate chemical weapons detection as well. They detect nerve and blister agents, such as Tabun, Sarin, Soman, Cyclosarin, Agent VX and Vx, Nitrogen Mustard 3, and others.

Particle detectors work under the premise that a person handling explosives will become contaminated and the exterior of the vehicle would have trace amounts. These devices have been used with minimal success in detecting explosive development because they are best at identifying rarely-used explosive compounds. In addition, such detectors will only deliver their intended reliability if the operator has access to vehicles' internal compartments, thereby increasing the intrusiveness rating.

Special training requirements include equipment calibration, daily maintenance and cleaning procedures, and identification of false positive readings. As fairly new technology, these devices are available from a few technology developers/OEMs.

- **Time:** 1 minute per vehicle.
- **Staff**: 1 minimum.
- **Intrusiveness**: No personal contact with vehicle.
- **Investment**: $40,000 per installation.
- **Maintenance**: Minimal calibration by OEM, 5 minutes of maintenance and battery charge every 90 minutes.
- **Expertise**: Requires training estimated at one day and provided by the OEM.

Chemical reagent detection kits are aerosol-based field test devices that cost about $200 per unit. The kits normally include 50 test papers, verification papers and three cans of spray. The collection process takes only a few minutes, and the test is immediate. The detection capability is limited to Group A explosives (TNT, TNB, etc.), Group B explosives (Semtex H, RDX, etc.) and compounds that may contain nitrates used in improvised explosives. They require a lot of explosive residue to provide a positive detection. Most reagents are toxic and require special training and handling, especially in a public area. Therefore, a staging area is required for the test. The time for moving a mobile test bench throughout the vehicle screening area and/or running samples back to a staging area can require up to 10 minutes per screening.

Although not required, access to the internal compartments of the vehicles would increase reliability in detection thereby increasing the intrusiveness rating. The suspect area is wiped with an adhesive collection paper and the spray is consecutively applied with each of three different sprays until an immediate color reaction indicates a positive identification. This methodology is fast and efficient, providing immediate test results.

Special training for taking samples from the vehicles enables personnel to understand and relevant legislation and procedural requirements, as well as to recognize a positive test indication. This technology is readily available and can be obtained from several OEMs.

- **Time**: 5 minutes per vehicle.
- **Staff**: 1 minimum.
- **Intrusiveness**: Requires wiping with a sample gathering cloth of vehicle.
- **Investment**: No up front cost.
- **Maintenance**: Minimal calibration by OEM, 5 minutes of maintenance and battery charge every 90 minutes.
- **Expertise:** Requires training estimated at one day and provided by the OEM.

2.4.3 Visual Inspection

Inspection mirrors, in their most elaborate forms, cost up to $1,000. They provide a view of the underside of vehicles with lights and dual periscopic mirrors mounted on a dolly with wheel casters. This allows the operator to remain standing during a detailed inspection of the undercarriage. The power source for lighting is civil 110 volts and requires proximity to an electrical outlet. Simple inspection mirrors allow staff to look under a vehicle during a walk around, and cost less than $100. These devices are a mirror mounted on a telescoping wand and are augmented with the use of a flashlight. The lack of lighting causes recognition of details to be cumbersome. Special training for the operation of both types of mirrors requires requisite knowledge of various vehicle undercarriage configurations and how to identify recently modified components and access panels.

This approach is limited to screening the undercarriage and outside of the vehicle and must be combined with an approach to check the internal compartments of a vehicle. Visual inspection by staff provides a psychological deterrent with a simple walk around of a vehicle. At the Texas-Mexico border, CBP personnel perform “walk-around” driver and vehicle inspections. The inspectors look for suspicious material as well as the unusual behavior of occupants. Special training requirements include: how to observe and monitor people, how to report information and observations in an appropriate manner, and how to relate to people from a range of social, cultural, and ethnic backgrounds and varying physical and mental abilities. The “walk-around” requires experienced staff with the appropriate training, such as previous law enforcement and/or customs inspection backgrounds.

- **Time:** 2 minutes per vehicle.
- **Staff**: 1 minimum.
- **Intrusiveness**: Climbing around vehicle to gain advantage points not provided by mirrors may require contact with the vehicle.
- **Investment**: Less than $1,000 per installation.
- **Maintenance**: None.
- **Expertise:** In addition to law enforcement and/or customs experience, this approach requires specialized training estimated at three weeks and $2,500 for each inspector.

2.4.4 Dogs

Screening dogs (K-9s) are highly-trained canines that have undergone intensive training and behavioral programs costing about $20 thousand per animal. They detect firearms, explosives, and explosive compounds, including: commercial dynamite, ammonium nitrate, C-4 or Flex-X, TNT or military dynamite, primer cord and slurries or water gel.

Although not required, access by screening dogs to vehicles’ internal compartments would increase reliability in detection, but increase the intrusiveness of this approach.

A K-9 requires a break every 30 to 45 minutes of work. K-9s requires kennel facilities, trained caregivers, food and medicine, and special transportation to and from inspection sites. The overall maintenance costs for a K-9 can be $50,000 per year. Skilled staff to guide the explosive-sensitive K-9 and interpret its behavior are required, with a staff training cost between $1500 and $6000 per person. Governments and industries utilize the K-9 as a cost effective and efficient chemical detector as well as a good psychological deterrent.

- **Time**: 1 minute per vehicle.
- **Staff**: 1 minimum per dog (inspector only).
- **Intrusiveness**: No personal contact with vehicle.
- **Investment**: $20,000 per animal.
- **Maintenance**: Requires a trained caregiver, a kennel, food and regular veterinary care equivalent to one staff member per dog. (Care of multiple dogs experience economics of scale, reducing individual maintenance costs.) Ownership and maintenance of K-9s can be contracted out, the primary strategy in industry.
- **Expertise**: Requires specialized training estimated at three weeks and up to $6,000 per inspector.

2.4.5 Technology Evaluation

Table 6 compares surveyed technologies with respect to the defined criteria. The time requirements are derived from the technical specifications provided by the OEMs, including the staging of vehicles, materiel, and staff. The staffing requirements are estimates based on the survey of actual installations. The intrusiveness rating of High is for screening activities that disturb the vehicles through unloading or touching (i.e., sample wipe), and Low when the occupants and vehicle are not disturbed at all. The full time equivalent (FTE) of $50,000 was used to estimate a cost of $0.40 per staff minute to operate the technology.

Table 6 - Comparison of Vehicle Screening Technologies

Technology	**Time to Screen 1 Vehicle (minutes)**	**Staffing to Support the Technology**	**Intrusive-ness**	**Capital Cost (One Location)**	**Operating Cost (One Screening @ $.40/staff minute)**
Whole Vehicle					
X-ray	10	2 FTE=$100,000	Low	$10,000,000	$8.00
Under vehicle CCTV	1	2 FTE=$100,000	Low	$6,000	$0.80
Hand Held					
Portable X-ray	5	1 FTE=$50,000	High	$150,000	$2.00
Vapor/Particle Detectors	1	1 FTE=$50,000	Low	$40,000	$0.40
Chemical Reagents (e.g., Expray)	5	1 FTE=$50,000	High	N/A $4/test	$6.00
Visual					
Inspection Mirrors	2	1 FTE=$50,000	Medium	$1,000	$0.80
Dogs					
K-9	1	2 FTE=$100,000	Low	$26,000	$0.80

3. CVISN ELECTRONIC BORDER SCREENING EDI IMPLEMENTATION GUIDELINES

This section is consistent with the guide that was prepared by The Johns Hopkins University Applied Physics Laboratory (JHU/APL), under contract to the US Department of Transportation (DOT), Federal Motor Carrier Safety Administration (FMCSA). The purpose of this section is to outline in general terms the Electronic Data Interface (EDI) transaction data sets that must also coincide with any advanced technology deployments at the border regarding CVISN. These EDI data sets relate to the information exchanged between government agencies to verify the regulatory compliance of motor carriers that travel across the border and operate in Arizona.

EDI transactions provide standard, predefined messages among stakeholders to communicate CVO-related information and allow computers to process information such as safety data and electronic screening enrollments. EDI transactions support data interfaces across various jurisdictions and between public (e.g., state motor vehicle administration) and private (e.g., carrier) offices.

The purpose of this section is to provide information one or more connections using Accredited Standards Committee (ASC) X12 EDI Transaction Set (TS) 286 for electronic screening enrollment transactions.

3.1 Applicability

This section provides specific coding information for implementing TS 286 for electronic screening-related enrollment transactions that take place between an applicant and an issuing jurisdiction. The primary benefactor of information contained in this section is an EDI programmer tasked with implementing the 286 for such transactions, but we feel it important to have this information contained in this report for consistency.

The transaction set syntax followed in this section is that set by the American National Standards (ANSI) Accredited Standards Committee X12. An international EDI standard, the UN/EDIFACT standard is not presently in wide use in U.S. commercial vehicle businesses.

3.2 Associated Transaction Sets

The following transaction sets (transaction sets are pre-defined data packets of information that are communicated between systems) are associated with the TS 286 in an electronic screening enrollment processing model.

- TS 285 (Commercial Vehicle Safety and Credentials Information Exchange): Provide standard, pre-defined messages among stakeholders to communicate CVO-related information and to allow computers to process safety and credential data.
- TS 997 (Functional Acknowledgment): Acknowledge receipt of message. Communicate syntax problems in received message.

3.3 Responsible Organizations

A partnership of organizations will be responsible for the development and maintenance of information exchange and for supporting carrier and state implementation of commercial vehicle transactions. These organizations and their roles are:

Federal Motor Carrier Safety Administration – Direct and fund the development of ANSI ASC X12 format transaction sets and associated documentation to support CVO under the ITS/CVISN architecture, and to encourage their use in CVO nationwide.

American National Standards Institute Accredited Standard Committee X12 –Develop, maintain, interpret, publish, and promote the proper use of American national standards and international standards for electronic data interchange.

The Johns Hopkins University Applied Physics Laboratory - Develop and maintain transaction sets and prepare or coordinate the preparation of related documentation for the electronic data interchange of all safety-related information and credentials associated with commercial vehicle operations under a contract with FMCSA for development of an architecture for CVISN and the Safety and Fitness Electronic Records (SAFER) system.

Intelligent Decision Technologies, Ltd. - (Southwest One-Stop, Maryland and Minnesota CVISN development) **-** Develop software to enable commercial vehicle operators to obtain all required tax and regulatory credentials from a single source.

3.4 Commercial Vehicle Credentials Transaction Set (TS 286)

The Commercial Vehicle Credentials Transaction Set (TS 286) allows the electronic application, granting, and authorized exchange of credentials-related information required for the safe and legal operation of commercial vehicles. It can be used to exchange credential data among carriers, state jurisdictions and other authoritative centers, roadside check sites, and authorized industry representatives. TS 286 supports the information exchanged for several credential types, and state variations of different forms for each credential type, in a common transaction set. A one-stop process, where an applicant can electronically apply for all tax and regulatory credentials from a single location, is the envisioned EDI application

The data flows associated with commercial vehicle electronic screening enrollment are summarized in **Error! Reference source not found.** 8 as part of the CVISN architecture and provide to a users for a high-level perspective on the major interfaces between carriers and state agencies (jurisdictions) for the electronic screening enrollment process.

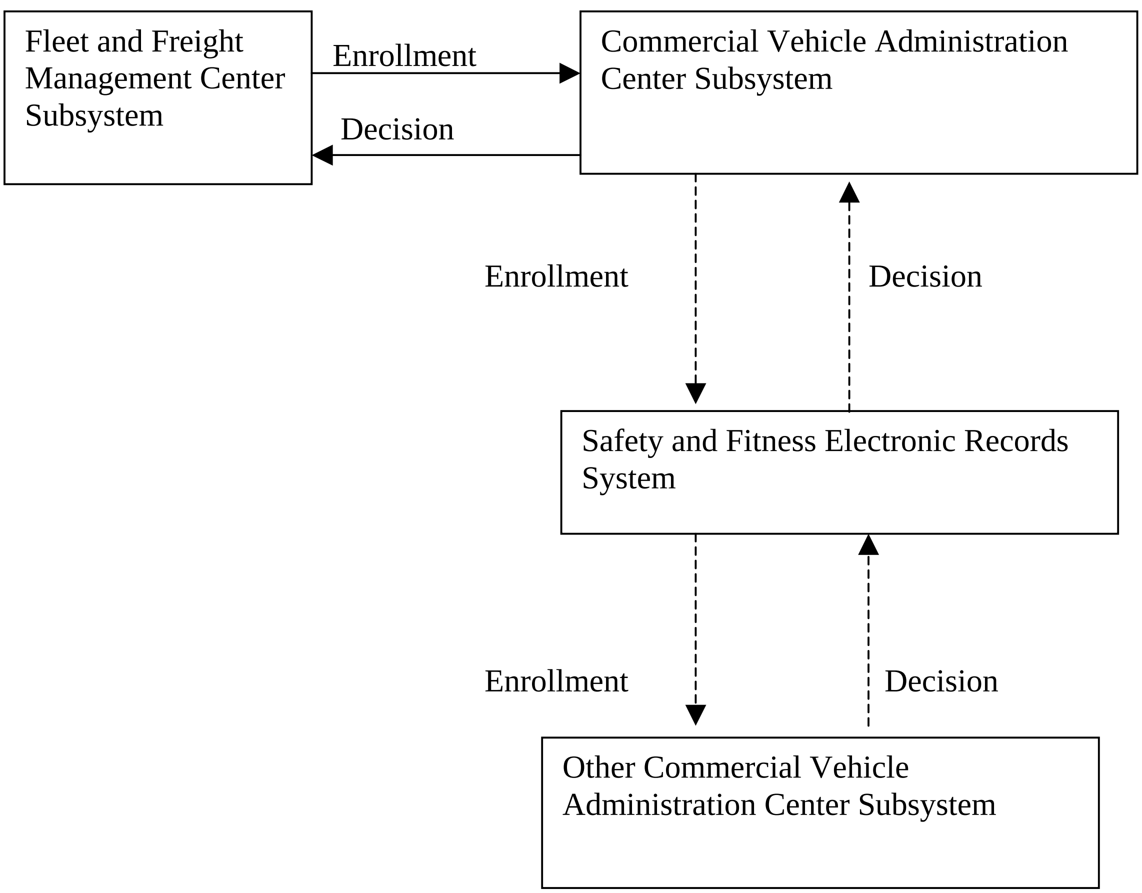

Figure 7: CVISN Architecture Flow Diagram for Commercial Vehicle Electronic Screening Enrollment

All interfaces shown are EDI transmissions of electronic screening-related information and include a standard functional acknowledgment (TS 997). All solid lines indicate TS 286; dotted lines are TS 285.

TS 286 is one of several EDI transaction sets developed as part of the CVISN project. CVISN is a U.S. DOT/FMCSA project that is generally concerned with applying technology to improve the safety and efficiency of North American commercial vehicle operations. The CVISN design has identified EDI as a key to communicating data related to commercial vehicles and their operations in an efficient, open, and accessible manner. This includes the electronic application for credentials, automatic processing of the electronic application, and electronic return of credentials information.

The CVISN architecture will enable authorized stakeholders to exchange electronic information via open standards and using a variety of transmission options. Individual jurisdictions, or their designated agent, will be the authoritative source of information on credentials that they issue. The U.S. DOT/FMCSA is also encouraging the development of credentialing and permitting under regional agreements, and the implementation of clearinghouses to support that concept.

3.5 Electronic Border Screening Program

Screening, applied to commercial vehicles, is a selection mechanism to make efficient use of limited fixed weigh station and inspection resources. Electronic border screening is the application of technology to this process, in order to make an informed decision about whether further examination of a vehicle is required. Properly implemented, electronic border screening results in improved station traffic flow, focused vehicle inspections, increased compliance and ultimately achieves the goals of increased safety and reduced operating costs. Electronic border screening is a voluntary program that will allow vehicles with acceptable safety and inspection histories, and whose credentials are in order, to pass roadside sites without being stopped. Applicants select the jurisdiction(s) in which they wish to enroll and identify the vehicles to be operated in those jurisdictions. Jurisdiction electronic screening policies are outside the scope of this document.

The following provides implementation conventions for using the 286 to exchange data for:

- Carrier-to state transactions
  - Carrier initial enrollment
  - Carrier supplemental enrollment
  - Vehicle enrollment

- State-to-carrier transactions
  - Enrollment state rejection
  - Enrollment response

A fleet and freight management center or service provider will use TS 286 to enroll in an electronic screening program with the appropriate commercial vehicle administration. The commercial vehicle administration of the enrollment state will respond to the electronic screening (or disapprove, request re-transmittal/clarification) via EDI to the fleet and freight management center. States will exchange information on electronic screening via SAFER provided information. A commercial vehicle administration will supply electronic screening information and a copy of the electronic screening information to authorized requesters.

3.5.1 Submit Electronic Screening Enrollment

An applicant initiates the process by requesting enrollment in one or more electronic screening programs. Typically, initiated by the fleet and freight Management center for carrier requests.

3.5.2 Respond to Electronic Screening Enrollment

Upon receiving a valid initial enrollment application, the enrollment state forwards the information to the SAFER system for distribution to the jurisdictions specified by the applicant. Each jurisdiction processes the data and either approves or disapproves the carrier's participation. SAFER receives each jurisdiction's decision and distributes the decision to the enrollment state. The enrollment state then:

- Optionally notifies the applicant of each jurisdiction's approval or disapproval.
- Requests a retransmittal or clarification of the information in the enrollment application.

If the information submitted was not valid, that is, there is no existing data for the carrier or the vehicle(s), or there is some other semantic problem, the enrollment state may send a rejection to the applicant and not forward any data.

3.5.3 Vehicle Enrollment

After carrier enrollment into a program, the applicant specifies each vehicle, and its jurisdictions, to be enrolled. The enrollment may be denied if a vehicle is not currently registered or SAFER has not received the carrier enrollment information.

3.5.4 Security

Where applicable, trading partners are responsible for following Federal Information Processing Standards (FIPS) and other statutes relating to computer security and privacy, including the Privacy Act of 1974. The following documents provide guidance in these areas:

- National Institute of Standards & Technology (NIST) FIPS (112) for passwords.
- NIST Special Publication 800-9, "Good Security Practices for Electronic Commerce, Including Electronic Data Interchange."

3.5.5 Acknowledgment Procedures

Received messages, except for the 997 transaction set, are uniformly acknowledged with a 997 (Functional Acknowledgment) transaction set. The location and nature of syntax errors in a received message are communicated with a 997. Syntactic correctness means compliance with the X12 standard specified in this document. Possible 997 codes indicating accept or reject condition based on the syntax editing of the transaction set:

Code	Description
A	Accepted
E	Accepted But Errors Were Noted
R	Rejected

Messages received that are not in compliance with the appropriate implementation guide, e.g., with elements or segments designated as "Not Used" or unapproved codes, shall be acknowledged, if no syntax errors are detected, with a 286. Problems with the meaning and completeness (semantic content) of the received message are communicated by returning a 286 with an appropriate comment. Legal considerations for this implementation include:

Recordkeeping - Consider the legal issues when developing policies and procedures for the recording of EDI data.

Authentication - Verify the authenticity of the sender and receiver, as well as the content of the messages.

Trading Partner Agreements - Address the importance of trading partner agreements. Identify other related selected issues that should be considered when drafting an agreement. Trading partners are bound by the terms and conditions in this agreement and its included regulations. A model trading partner agreement has been developed by the American Bar Association (ABA) and addresses the major issues when using EDI. This model agreement may be customized to meet specific needs of trading partners.

Third Party Agreements - Identify any issues that users and networks should consider when negotiating EDI contracts.

Laws, Rules, and Regulations - Consider existing laws, rules, and regulations that should be consulted during implementation.

4. PROJECT IMPLEMENTATION

The major work tasks to be completed are to design, install, and evaluate the border crossing system. The tasks and deliverables involved in this process include the following:

Task 1: Exploration of other border crossing clearance systems (technical memo)
Task 2: Evaluation of existing technology (technical memo).
Task 3: Development of a concept of operation (design plan and acceptance plan).
Task 4: Institutional coordination (technical memo).
Task 5: System design documentation (technical memo).
Task 6: Deployment of an ITS/CVO infrastructure in the border corridor (working system and user documentation).
Task 7: Evaluation, recommendations, and documentation of the project (draft and final report).

4.1 Tasks

These tasks are discussed in more detail as follows.

4.1.1 Exploration of Other Border Systems

Because this proposed project is to be interoperable, it will be necessary to examine, mainly through document review and telephone interviews, other CVO border crossing sites and associated data systems. Principal among these systems is the FHWA's ongoing field operational tests in Buffalo, New York, Detroit, Michigan, Otay Mesa, California, Sweet Grass, Montana, and several sites in Texas. The success and problems with these systems will be examined, and this information will be used to guide the development of the CVO border crossing system. This effort will ensure that the proposed system will use proven technology and will be compatible with other systems in the country.

4.1.2 Evaluation of Existing Technology

Because the project is to be a functional deployment of a CVO system, the technology used will need to be reliable and tested. This will require the evaluation of existing technology. Ideally the hardware, such as readers and transponders, will be commercially available. The software and system architecture selected will be guided by the CVISN architecture standards being developed by John Hopkins University, Applied Physics Laboratory, the field demonstration of NATAP, the IBC system architecture, and experience acquired during the EPIC project.

4.1.3 Concept of Operation

The main purpose of this task will be to determine what type of electronic clearance and credentialing system should be developed. It will necessitate the development of an operational plan based on the previous tasks. The resulting document will present the conceptual design of the system and discuss objectives of the system.

4.1.4 Institutional Coordination

The success of this project will require contact with a number of agencies and private firms involved in international trade and work with staff from these agencies to ensure that the system provides the capabilities needed by various end-users. As part of this task, the financial participation by other agencies must be sought.

In addition, subsequent work will require the cooperation with the following institutions:

- FHWA
- Participating customs brokers/shipping companies
- Mexican government (federal and Sonoran)
- Mexican trucking associations
- Arizona trucking association

To develop an effective system, collaboration will be needed with the following agencies with responsibility in the border corridor:

- Customs brokers/shipping companies
- Mexican customs services
- ADOT – DOT and DMV
- U.S. General Services Administration
- U.S. Immigration and Naturalization Service
- U.S. Department of Agriculture
- Arizona Trucking Association
- Mexican Trucking Association
- Private trucking firms
- Border cities
- Customs brokers

4.1.5 Systems Design Document

One of the primary goals of this project will be to develop a functioning and reliable ITS-based CVO system. The successful deployment of this technology will require evaluation of the software, hardware, and communication requirements and then procure the equipment. Because of the need for interoperability, software used in the system is expected to guided by CVISN, the IBC system architecture, and the CBP Automated Manifest System (AMS). The determination of the hardware used will guided by availability from commercial vendors, results from other border crossing systems, and cost. Communication requirements will relate to the characteristics of the hardware and software, as well as to the physical location of the hardware. This element will require that the contractor create a specific plan for the hardware and software used for the systems. This design will be used as a "blueprint" for the actual infrastructure installation completed in the next task.

Concurrent with the design plan, an acceptance test plan must be created. This plan will discuss the acceptable functionality of both the hardware and software in the final system. ADOT will use this plan to develop a document used to accept the final system.

Several issues will need to be resolved in this task. Because both the DPS and CBP will be significantly involved with the infrastructure and systems used with this project, the transponder location and design will need to be compatible with these agencies' missions. DPS regulates and enforces vehicle licensing, safety, and weight. Electronic tags that are read at the weigh station(s) will need to refer to vehicle characteristics. This will require a transponder tag on the power unit (the tractor) that holds and communicates information about that vehicle or has an ID number that refers to a vehicle information database. The actual software and information format on the tag will be determined by CVISN standards. The communication between the reader and the vehicle transponder will match the FHWA's current DSRC standard.

The CBP's interest in commercial vehicle movement primarily focuses on commodity movements. Therefore, CBP mainly requires information related to the cargo on the commercial vehicle. Its Automated Equipment Identifier (AEI) program uses tags on the container, as opposed to the power unit. For security reasons these tags can only contain a container ID number. The ID will then be used by a CBP agent to access a CBP database containing cargo documentation. The format of the container ID number and the associated database will most likely be guided by the successes at NATAP. The standards for the communication interface between the container and the readers at the port and the border station will use the ISO 10374. This has been an international standard since 1991, is widely used by shipping companies, and many containers are equipped with ISO 10374 tags.

Because the infrastructure installations will start out with different communication interfaces, one important aspect of this element will be to link the power unit tags (under ASTM #6 or #7) and the container tags (ISO 10374). For this project, a simple database link between the ID number on each tag may be reasonable. This linkage will provide a foundation for enforcement staff to share information. Such information sharing will be valuable to both agencies while facilitating vehicle movements. A link, for example, would permit an enforcement officer to determine the contents of a container being carried by a truck. Such information would be practically valuable in situations involving hazardous cargoes. In turn, information from enforcement managed weigh-station facilities would permit staff to monitor travel times and the route of cargo traveling between the port and the border stations. Such information would assist in enforcement actions. Other useful information exchanges that enhance the viability of the system will be identified.

Readers at the port’s out-gates would record the departure of the container and activate an en route message. At this point, the ISO 10374 tags on the containers might be associated, via a software patch, with an ASTM tag on the truck hauling the container. The truck tag would contain safety, licensing, and other information following CVISN standards. As this vehicle approaches other weigh stations, an ASTM reader would register the tag and record this information. This information would be available for enforcement for monitoring the progress of the in-bond cargo. Shortly before the Nogales border station, readers would confirm the arrival of the truck (one ASTM #6 reader) and the container (one ISO 10374 reader). These two readers would be used to confirm that the correct truck was hauling the correct container. If they matched, the customs inspector could automatically export the container. The inspector could also decide to inspect the container, and the truck would be pulled over.

The proposed system would also address southbound movements of these vehicles. This aspect of the project would include a southbound ASTM reader, combined with mainline Weigh-in-Motion. These facilities would permit enforcement to allow vehicles to bypass the weigh station without the need to stop.

4.1.6 Installation of ITS Infrastructure

The contractor will procure and install the software, hardware, and communication links guided by the systems design plan. The contractor will be expected to purchase enough readers and transponder tags to initiate the system. The contractor will work with other agencies and attempt to obtain support from these agencies for purchasing further readers and tags.

The contractor will ensure correct installation and then debug and turn on the system. The contractor will provide sufficient support until the system has been accepted. Acceptance will occur after three months of full and consistent operation and after the system has passed an acceptance checklist created from the acceptance test plan developed in task 5. The contractor will also be responsible for training CBP personnel and staff from other involved agencies in the use of the system. The contractor will develop user manuals and whatever other support materials are necessary for system training and maintenance.

4.1.7 Evaluation, Recommendations, and Documentation

To measure the benefits provided by the CVO border crossing project, both quantitative and qualitative aspects of the system will need to be evaluated. The development of an evaluation process can be guided by the formal process developed by the FHWA for the field operational tests at other border sites, as well as by FHWA's technical assistance programs. It may be reasonable to survey users of the system to gauge the satisfaction and effectiveness of the system. The contractor will, as required,

- Conduct briefings on the system design, work plan, schedule, and development/ implementation issues.

- Participate in various evaluation, planning, and review activities.

Once the evaluation has been completed, a set of recommendations shall be developed. These recommendations are expected to suggest how to effectively expand this initial deployment.

4.1.8 Future Phases

The initial phase developed in the tasks above will serve as starting point for future phases. These later phases, while not funded, would expand the CVO systems and provide greater benefits to a wider range of commercial vehicle operators.

A second phase would stress technological improvements and facilitate CVO operations in both directions across the border. Elements that would be completed as part of this phase would include participation by Mexican customs with hardware on the Mexican side of the border continue to explore the findings from the other field operational tests and the NATAP implementation upgrade to new DSRC standards add ITS/CVO facilities at other weigh stations, corridor adopt upcoming technology to improve system efficiency and perhaps electronically link container tags and power unit tags on each vehicle.

A third phase would focus on expanding the CVO system to other areas. Elements completed as part of this phase would fully integrate the standardized data and document processes developed by NATAP include more and different types of commercial vehicles expand the system network to include the entire Interstate 15, Interstate 5 and Interstate 40 corridors.

4.2 Project Products

4.2.1 CVO Border System

The main deliverable to ADOT will be a fully functioning CVO border crossing system that will provide electronic arrival information for containers traveling across the border. A container-based system will be linked to a second system that contains information on the vehicle and driver. This system will be designed so it may be integrated with other border crossing initiatives, will be interoperable with other national CVO border, and will be oriented toward future expansion.

4.2.2 Documents

As part of the development of this project, various technical memoranda and reports will be prepared. The state, at its option, may copy, revise, and reprint any or all documents. The state, at their option, may reduce the total number of any or all documentation required under this contract. Copies of all document produced under this contract will be provided to the FHWA.

4.3 Project Management

4.3.1 Project Technical Advisory Committee

ADOT will establish a project technical advisory committee. The committee will consist of appropriate personnel from:

- FHWA
- ADOT
- Arizona Department of Public Safety
- Bureau of Customs and Border Protection
- U.S. Department of Agriculture
- Department of Homeland Security
- Participating customs brokers

Personnel from other agencies will be added as needed.

4.3.2 Project Schedule

Upon receipt of notice to proceed, a project schedule will be prepared and submitted to the project manager for review and approval. The schedule will call for completion in 18 months. The schedule will identify the duration and sequence of the project work tasks.

The project schedule will be used to coordinate project activities. It will be monitored to ensure that work tasks are started and completed on time. If necessary the initial project schedule can be modified to reflect variables such as time for review of CVO design documents by the involved agencies and end users, any equipment ordering backlog, and other situations beyond the Contractor’s control.

4.3.3 Monthly Progress Reports

Monthly progress reports will be prepared by the contractor and delivered to ADOT. These reports will include a narrative of the major activities performed during the month.

Work sheets showing hours expended by work tasks, original budgeted hours by work task, and updated estimates of hours needed to complete each work task will be attached to the narrative. Total staff hours and budget utilized to date will be compared to initial projections to provide an accurate reflection of the current status of the project.

4.3.4 Outreach Project Schedule

The ADOT will be responsible for outreach designed to stimulate interest and increase understanding of this project.